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WESTERNGECO L.L.C.
10001 RICHMOND AVENUE
(P.O. BOX 2469, HOUSTON, TX 77252-2469, U.S.A.)
HOUSTON, TX 77042

EXAMINER	
HUGHES, SCOTT A	

ART UNIT	PAPER NUMBER
3663	

DATE MAILED: 04/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/671,100	HOWLID ET AL.	
	Examiner	Art Unit	
	Scott A Hughes	3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *1/27/2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,7,9,11,13,14,16,18 and 20-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,7,9,11,13,14,16,18 and 20-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 1-5, 7, 9, 11, 13-14, 16, 18, and 20-33 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3, 5-6, 14-15, 20-21, 23-24 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Haughland (4721180) in view of Robertsson (WO0057207).

With regard to claim 1, Haughland discloses a method of processing seismic data (Column 1, Lines 10-20; Column 3, Lines 45-60). Haughland teaches acquiring seismic data using a seismic source array configured to provide at least two seismic signals having frequency spectra within the seismic bandwidth that contain a source ghost at a non-zero frequency, said at least two seismic signals combining to form a seismic wavefield having a frequency spectrum within the seismic bandwidth that does not contain a source ghost at a non-zero frequency (Column 1, Lines 10-20; Column 2, Lines 40-45; Column 3, Lines 45-60; Column 5, Line 33 to Column 6, Line 18). Haughland does not processing the acquired seismic data thereby to attenuate the effect of ghost reflections in the seismic data. Haughland discloses that the seismic

signals emitted from the sources are detected by sensors in towed streamers for use in obtaining information about strata below the body of water. Haughland does not disclose the specifics of this data processing. Robertsson teaches that seismic data received in marine seismic surveys using a streamer is de-ghosted during processing (abstract; Page 1, Lines 1-20; Page 3; Page 6, Line 10 to Page 7, Line 2; Page 9, Lines 1-8; Page 14, Lines 1-20; Pages 15-16; Page 19, Line 28 to Page 20) (Figs. 6a-f). It would have been obvious to modify Haughland to include de-ghosting the seismic data received at the streamer as taught by Robertsson in order to remove the ghost reflections which obscure the desired signals recorded at the streamer that are used in the seismic survey.

With regard to claim 2, Haughland discloses providing a seismic wavefield having a frequency spectrum that does not contain a source ghost at non-zero frequency in the frequency range up to 500Hz, for a take-off angle of up to 45 degrees (Column 1, Lines 10-20; Column 2, Lines 40-45; Column 3, Lines 45-60; Column 5, Line 33 to Column 6, Line 18).

With regard to claim 3, Robertsson discloses processing the seismic data to attenuate the effects of receiver-side ghost reflections (Figs. 6a-f) (Pages 9, 14).

With regard to claim 4, Robertsson disclose a method of de-ghosting involving separating the data into up-going and down-going constituents (abstract; Pages 1, 6).

With regard to claim 5, Haughland discloses a method of acquiring seismic data. Haughland discloses providing at least two seismic signals having frequency spectra within the seismic bandwidth that contain a source ghost at a non-zero frequency, said

at least two signals combining to form seismic energy having a frequency spectrum that does not contain a source ghost notch at a non-zero frequency within the seismic bandwidth (Column 1, Lines 10-20; Column 2, Lines 40-45; Column 3, Lines 45-60; Column 5, Line 33 to Column 6, Line 18). Haughland does not disclose acquiring seismic data in response to providing the at least two signals and processing the acquired seismic data thereby to attenuate the effect of the ghost reflections. Haughland discloses acquiring seismic data in response to providing the signals, but does not disclose the specifics of the processing of the data (Column 1, Column 3, lines 45-60). Robertsson teaches that seismic data received in marine seismic surveys using a streamer is de-ghosted during processing (abstract; Page 1, Lines 1-20; Page 3; Page 6, Line 10 to Page 7, Line 2; Page 9, Lines 1-8; Page 14, Lines 1-20; Pages 15-16; Page 19, Line 28 to Page 20) (Figs. 6a-f). It would have been obvious to modify Haughland to include de-ghosting the seismic data received at the streamer as taught by Robertsson in order to remove the ghost reflections which obscure the desired signals recorded at the streamer that are used in the seismic survey.

With regard to claims 7, Haughland discloses that providing the at least two seismic signals comprises providing the at least two seismic signals from at least two different locations (Column 5, Line 33 to Column 6, Line 11) (Fig. 1).

With regard to claim 9, Haughland discloses that providing the at least two seismic signals comprises providing the at least two seismic signals from a first location and a second location disposed, in use, vertically below the first location (Column 5, Line 33 to Column 6, Line 11) (Fig. 1).

With regard to claim 11, Haughland discloses that providing the at least two seismic signals comprises providing at least one first seismic signal a predetermined time after providing at least one second seismic signal (Column 5, Lines 30-41; Column 5, Line 54 to Column 6, Line 11).

With regard to claim 13, Haughland discloses that the predetermined time is substantially equal to the travel time of seismic energy from the first location to the second location (Column 5, Lines 30-41). Haughland discloses that the difference in depth between the two sources is 3 meters, and that the velocity of sound in water is 1500 m/s. Haughland then discloses firing the second source 3/1500 s after the first. Since the sound travels at 1500m/s and the separation between sources is 3 meters, it will take 3/1500 s for the seismic energy to travel from the first location to the second, which is equal to the delay time.

With regard to claim 14, Haughland discloses that providing the at least two seismic signals comprises providing at least one seismic signal from a location substantially at the surface of a water column (Column 5, Lines 33-41) (Fig. 1).

With regard to claim 20, Haughland discloses an apparatus for processing seismic data acquired using a seismic source array configured to provide at least two seismic signals having frequency spectra within the seismic bandwidth that contain a source ghost at a non-zero frequency, the at least two seismic signals combining to form a seismic wavefield having a frequency spectrum that does not contain a notch at a non-zero frequency (Column 1, Lines 10-20; Column 2, Lines 40-45; Column 3, Lines 45-60; Column 5, Line 33 to Column 6, Line 18). Haughland does not disclose the

apparatus comprising a means for processing the acquired seismic data thereby to attenuate the effect of ghost reflections in the seismic data. Robertsson teaches that seismic data received in marine seismic surveys using a streamer is de-ghosted during processing (abstract; Page 1, Lines 1-20; Page 3; Page 6, Line 10 to Page 7, Line 2; Page 9, Lines 1-8; Page 14, Lines 1-20; Pages 15-16; Page 19, Line 28 to Page 20) (Figs. 6a-f). It would have been obvious to modify Haughland to include de-ghosting the seismic data received at the streamer as taught by Robertsson in order to remove the ghost reflections which obscure the desired signals recorded at the streamer that are used in the seismic survey.

With regard to claim 21, Robertsson discloses processing seismic data to attenuate the effects of receiver-side ghost reflections (Figs. 6a-f) (Pages 9, 14).

With regard to claim 22, Robertsson disclose a method of de-ghosting involving separating the data into up-going and down-going constituents (abstract; Pages 1, 6).

With regard to claim 23, Robertsson discloses a programmable data processor (Page 16).

With regard to claim 24, Haughland discloses a seismic surveying arrangement (Column 1, Lines 10-20; Column 3, Lines 45-60). Haughland discloses a seismic source array configured to provide at least two seismic signals having frequency spectra within the seismic bandwidth that contain a source ghost at a non-zero frequency, the at least two seismic signals combining to form a seismic wavefield having a frequency spectrum that does not contain a notch at a non-zero frequency (Column 1, Lines 10-20; Column 2, Lines 40-45; Column 3, Lines 45-60; Column 5, Line 33 to Column 6,

Line 18). Haughland does not disclose one or more seismic receivers for acquiring seismic data and an apparatus for processing seismic data acquired by the receivers. Haughland discloses acquiring seismic data with receivers in response to providing the signals, but does not disclose the specifics of the processing of the data (Column 1, Column 3, lines 45-60). Robertsson teaches that seismic data received with one or more receivers in marine seismic surveys using a streamer is de-ghosted during processing (abstract; Page 1, Lines 1-20; Page 3; Page 6, Line 10 to Page 7, Line 2; Page 9, Lines 1-8; Page 14, Lines 1-20; Pages 15-16; Page 19, Line 28 to Page 20) (Figs. 6a-f). It would have been obvious to modify Haughland to include de-ghosting the seismic data received at the streamer as taught by Robertsson in order to remove the ghost reflections which obscure the desired signals recorded at the streamer that are used in the seismic survey.

With regard to claim 25, Haughland discloses that the source array comprises a first source and a second source disposed below the first source (Column 5, Lines 30-41; Column 5, Line 51 to Column 6, line 11).

With regard to claim 26, Haughland discloses that the second source is vertically below the first source (Column 5, Lines 30-41; Column 5, Line 51 to Column 6, line 11) (Fig. 1).

With regard to claim 27, Haughland discloses a means for actuating the second source at a predetermined time after the first source (Column 5, Line 30 to Column 6, Line 11).

With regard to claim 28, Haughland discloses that the predetermined period of time is equal to the travel time of the seismic energy from the first source to the second source (Column 5, Lines 30-41). Haughland discloses that the difference in depth between the two sources is 3 meters, and that the velocity of sound in water is 1500 m/s. Haughland then discloses firing the second source 3/1500 s after the first. Since the sound travels at 1500m/s and the separation between sources is 3 meters, it will take 3/1500 s for the seismic energy to travel from the first location to the second, which is equal to the delay time.

With regard to claim 29, Haughland discloses that the sources are disposed substantially at the surface of a water column (Fig. 1) (Column 5, Line 30 to Column 6, Line 11).

With regard to claim 32, Robertsson discloses a storage medium comprising a program for a data processor (Page 16). It would have been obvious to modify Haughland to include using a storage medium and processor as taught by Robertsson in order to have a way to process the seismic data obtained in the seismic survey after the activation of the sources.

With regard to claim 33, Robertsson discloses a storage medium containing a program for controlling the data processor (page 16). It would have been obvious to modify Haughland to include using a storage medium and processor as taught by Robertsson in order to have a way to process the seismic data obtained in the seismic survey after the activation of the sources.

Claims 1-3, 5-6, 14-15, 20-21, 23-24 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ray (4493061) in view of Robertsson (WO0057207).

With regard to claim 1, Ray discloses a method of processing seismic data (Column 4, Lines 5-31; Column 5). Ray teaches acquiring seismic data using a seismic source array configured to provide at least two seismic signals having frequency spectra within the seismic bandwidth that contain a source ghost at a non-zero frequency, said at least two seismic signals combining to form a seismic wavefield having a frequency spectrum within the seismic bandwidth that does not contain a source ghost at a non-zero frequency (Column 4, Lines 5-31; Column 7, Lines 15-45). Ray does not disclose processing the acquired seismic data thereby to attenuate the effect of ghost reflections in the seismic data. Ray does not disclose the specifics of the data processing of the marine seismic survey. Robertsson teaches that seismic data received with one or more receivers in marine seismic surveys using a streamer is de-ghosted during processing (abstract; Page 1, Lines 1-20; Page 3; Page 6, Line 10 to Page 7, Line 2; Page 9, Lines 1-8; Page 14, Lines 1-20; Pages 15-16; Page 19, Line 28 to Page 20) (Figs. 6a-f). It would have been obvious to modify Ray to include de-ghosting the seismic data received at the streamer as taught by Robertsson in order to remove the ghost reflections which obscure the desired signals recorded at the streamer that are used in the seismic survey.

With regard to claim 2, Ray discloses providing a seismic wavefield having a frequency spectrum that does not contain a source ghost at non-zero frequency in the

frequency range up to 500Hz, for a take-off angle of up to 45 degrees (Columns 5, 7-8) (Figs 1-2).

With regard to claim 3, Robertsson discloses processing the seismic data to attenuate the effects of receiver-side ghost reflections (Figs. 6a-f) (Pages 9, 14).

With regard to claim 4, Robertsson disclose a method of de-ghosting involving separating the data into up-going and down-going constituents (abstract; Pages 1, 6).

With regard to claim 5, Ray discloses a method of acquiring seismic data. Ray discloses providing at least two seismic signals having frequency spectra within the seismic bandwidth that contain a source ghost at a non-zero frequency, said at least two signals combining to form seismic energy having a frequency spectrum that does not contain a source ghost notch at a non-zero frequency within the seismic bandwidth (Column 4, Lines 5-31; Column 7, Lines 15-45). Ray discloses acquiring seismic data in response to providing the at least two signals (Column 5). Ray does not disclose processing the acquired seismic data thereby to attenuate the effect of ghost reflections in the seismic data. Ray does not disclose the specifics of the data processing of the marine seismic survey. Robertsson teaches that seismic data received with one or more receivers in marine seismic surveys using a streamer is de-ghosted during processing (abstract; Page 1, Lines 1-20; Page 3; Page 6, Line 10 to Page 7, Line 2; Page 9, Lines 1-8; Page 14, Lines 1-20; Pages 15-16; Page 19, Line 28 to Page 20) (Figs. 6a-f). It would have been obvious to modify Ray to include de-ghosting the seismic data received at the streamer as taught by Robertsson in order to remove the

ghost reflections which obscure the desired signals recorded at the streamer that are used in the seismic survey.

With regard to claims 7, Ray discloses that providing the at least two seismic signals comprises providing the at least two seismic signals from at least two different locations (Column 4, Lines 5-31; Column 7, Lines 15-45) (Figs. 2, 5-7).

With regard to claim 9, Ray discloses that providing the at least two seismic signals comprises providing the at least two seismic signals from a first location and a second location disposed, in use, vertically below the first location (Column 4, Lines 5-31; Column 5, Lines 59-65; Column 7, Lines 15-45) (Figs. 2, 5-7).

With regard to claim 11, Ray discloses that providing the at least two seismic signals comprises providing at least one first seismic signal a predetermined time after providing at least one second seismic signal (Column 7).

With regard to claim 13, Ray discloses that the predetermined time is substantially equal to the travel time of seismic energy from the first location to the second location (Column 7).

With regard to claim 14, Ray discloses that providing the at least two seismic signals comprises providing at least one seismic signal from a location substantially at the surface of a water column (Fig. 2) (Column 5, Lines 59-65).

With regard to claim 20, Ray discloses an apparatus for processing seismic data acquired using a seismic source array configured to provide at least two seismic signals having frequency spectra within the seismic bandwidth that contain a source ghost at a non-zero frequency, the at least two seismic signals combining to form a seismic

wavefield having a frequency spectrum that does not contain a notch at a non-zero frequency (Column 4, Lines 5-31; Column 7, Lines 15-45). Ray does not disclose the apparatus comprising a means for processing the acquired seismic data thereby to attenuate the effect of ghost reflections in the seismic data. Ray discloses acquiring seismic data in response to providing the at least two signals (Column 5). Ray does not disclose processing the acquired seismic data thereby to attenuate the effect of ghost reflections in the seismic data. Ray does not disclose the specifics of the data processing of the marine seismic survey. Robertsson teaches that seismic data received with one or more receivers in marine seismic surveys using a streamer is de-ghosted during processing (abstract; Page 1, Lines 1-20; Page 3; Page 6, Line 10 to Page 7, Line 2; Page 9, Lines 1-8; Page 14, Lines 1-20; Pages 15-16; Page 19, Line 28 to Page 20) (Figs. 6a-f). It would have been obvious to modify Ray to include de-ghosting the seismic data received at the streamer as taught by Robertsson in order to remove the ghost reflections which obscure the desired signals recorded at the streamer that are used in the seismic survey.

With regard to claim 21, Robertsson discloses processing seismic data to attenuate the effects of receiver-side ghost reflections (Figs. 6a-f) (Pages 9, 14).

With regard to claim 22, Robertsson disclose a method of de-ghosting involving separating the data into up-going and down-going constituents (abstract; Pages 1, 6).

With regard to claim 23, Robertsson discloses a programmable data processor (Page 16).

With regard to claim 24, Ray discloses a seismic surveying arrangement. Ray discloses a seismic source array configured to provide at least two seismic signals having frequency spectra within the seismic bandwidth that contain a source ghost at a non-zero frequency, the at least two seismic signals combining to form a seismic wavefield having a frequency spectrum that does not contain a notch at a non-zero frequency (Column 4, Lines 5-31; Column 7, Lines 15-45). Ray does not disclose one or more seismic receivers for acquiring seismic data and an apparatus for processing seismic data acquired by the receivers. Ray discloses acquiring seismic data using receivers in response to providing the at least two signals (Column 5). Ray does not disclose processing the acquired seismic data thereby to attenuate the effect of ghost reflections in the seismic data. Ray does not disclose the specifics of the data processing of the marine seismic survey. Robertsson teaches that seismic data received with one or more receivers in marine seismic surveys using a streamer is de-ghosted during processing (abstract; Page 1, Lines 1-20; Page 3; Page 6, Line 10 to Page 7, Line 2; Page 9, Lines 1-8; Page 14, Lines 1-20; Pages 15-16; Page 19, Line 28 to Page 20) (Figs. 6a-f). It would have been obvious to modify Ray to include de-ghosting the seismic data received at the streamer as taught by Robertsson in order to remove the ghost reflections which obscure the desired signals recorded at the streamer that are used in the seismic survey.

With regard to claim 25, Ray discloses that the source array comprises a first source and a second source disposed below the first source (Figs. 2, 5-7) (Column 5, Lines 59-65).

With regard to claim 26, Ray discloses that the second source is vertically below the first source (Column 4, Lines 5-31; Column 5, Lines 59-65; Column 7, Lines 15-45) (Figs. 2, 5-7).

With regard to claim 27, Ray discloses a means for actuating the second source at a predetermined time after the first source (Column 7, Lines 15-45).

With regard to claim 28, Ray discloses that the predetermined period of time is equal to the travel time of the seismic energy from the first source to the second source (Column 7, Lines 15-45).

With regard to claim 29, Ray discloses that the sources are disposed substantially at the surface of a water column (Column 5, Lines 59-65) (Figs. 2, 5-7).

With regard to claim 32, Robertsson discloses a storage medium comprising a program for a data processor (Page 16). It would have been obvious to modify Ray to include using a storage medium and processor as taught by Robertsson in order to have a way to process the seismic data obtained in the seismic survey after the activation of the sources.

With regard to claim 33, Robertsson discloses a storage medium containing a program for controlling the data processor (page 16). It would have been obvious to modify Ray to include using a storage medium and processor as taught by Robertsson in order to have a way to process the seismic data obtained in the seismic survey after the activation of the sources.

Claims 16, 18, 30, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Haughland in view of Robertsson or Ray in view of Robertsson as applied to claims 1-5, 7, 9, 11, 13-14, 20-29, and 32-33 above, and further in view of Lee (6606278).

With regard to claims 16 and 30, Haughland and Ray do not disclose that the source array comprises means for absorbing upwardly emitted seismic energy. Lee teaches a bubble diffuser that suppresses the upwardly emitted waves from reflecting at the surface (abstract; Column 2). It would have been obvious to modify Haughland or Ray to include the means for absorbing the upwardly emitted seismic energy as taught by Lee in order to remove the waves that cause the ghost reflections at the surface.

With regard to claims 18 and 31, Haughland and ray do not disclose that the source array comprises means for inducing positive reflection of upwardly emitted seismic energy. Lee teaches a bubble diffuser that provides high acoustic reflection off of air bubbles (abstract; Column 2). It would have been obvious to modify Haughland or Ray to include the means for inducing positive reflection of the upwardly emitted seismic energy as taught by Lee in order to remove the waves that cause the ghost reflections at the surface.

Conclusion

The cited prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott A. Hughes whose telephone number is 571-272-6983. The examiner can normally be reached on M-F 9:00am to 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack Keith can be reached on (571) 272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SAH

JACK KEITH
SUPERVISORY PATENT EXAMINER